REGULATIONS FOR THE DEGREE OF MASTER OF SCIENCE IN ENGINEERING (MSc[Eng])

(See also General Regulations)

Any publication based on work approved for a higher degree should contain a reference to the effect that the work was submitted to the University of Hong Kong for the award of the degree.

The degree of Master of Science in Engineering (MSc[Eng]) is a postgraduate degree awarded for the satisfactory completion of a course of study in the Faculty of Engineering. The major part of the curriculum must be formed from modules offered in one of the following fields: building services engineering, communication engineering, computer and information technology**,** computers in manufacturing, electrical and electronic engineering, environmental engineering, geotechnical engineering, electronic commerce, industrial engineering and industrial management, infrastructure project management, internet computing, mechanical engineering, structural engineering, and transportation engineering. The MSc(Eng) is normally offered as a part-time programme. Some departments may offer a mode of study that enables a full-time candidate to complete in one year.

E12 Admission requirements

To be eligible for admission to the courses leading to the degree of Master of Science in Engineering, a candidate shall

(a) comply with the General Regulations;

(b) hold (1) a Bachelor's degree of this University in a relevant subject[1]; or

(2) another relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; or

(3) a Postgraduate Diploma in Engineering (PDipEng) of this University in a relevant field[2];

(c) satisfy the examiners in a qualifying examination if required.

E13 Qualifying examination

(a) A qualifying examination may be set to test the candidate's formal academic ability or his ability to follow the courses of study prescribed. It shall consist of one or more written papers or their equivalent and may include a project report.

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[1] For MSc(Eng) in Building Services Engineering: engineering or related sciences.
For MSc(Eng) in Communication Engineering or in Computer and Information Technology: physics, mathematics, or engineering
For MSc(Eng) in Computers in Manufacturing: engineering physical sciences or mathematics.
For MSc(Eng) in Electrical and Electronic Engineering: physics, mathematics or engineering.
For MSc(Eng) in Environmental Engineering: engineering or related sciences.
For MSc(Eng) in Geotechnical Engineering: civil engineering.
For MSc(Eng) in Industrial Engineering and Industrial Management: engineering, physical sciences or mathematics.
For MSc(Eng) in Infrastructure Project Management: engineering.
For MSc(Eng) in Mechanical Engineering: engineering, physical sciences or mathematics.
For MSc(Eng) in Structural Engineering: civil engineering.
For MSc(Eng) in Transportation Engineering: engineering or related sciences.

[2] Apply to students admitted to Postgraduate Diploma in Engineering in academic year 1998-99.

(b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he has satisfied the examiners in the examination.

E14 Award of degree

(a) To be eligible for the award of the degree of Master of Science in Engineering a candidate shall
  (i) comply with the General Regulations; and
  (ii) complete the curriculum and satisfy the examiners in accordance with the regulations set out below.

(b) A candidate who has completed 8 modules but has not satisfied the examiners for the award of the degree of Master of Science in Engineering may be awarded a PDipEng, subject to approval of the Faculty Board.

E15 Length of curriculum

For the part-time mode of study, the curriculum shall extend over not less than two and not more than three academic years of study. For the full-time mode, the curriculum shall extend over not less than one and not more than two academic years of study. In both cases, a minimum of 300 hours of prescribed work are required.

E16 Completion of curriculum

(a) To complete the curriculum a candidate shall, within the prescribed maximum period of study stipulated in Regulation E15 above:
  (i) follow courses of instruction and complete satisfactorily all prescribed practical / laboratory work; and
  (ii) shall either satisfy the examiners in either
    (1) twelve modules at the prescribed written examinations; or
    (2) eight modules and a project report or dissertation on a subject within his approved field of study.

  The examiners may also prescribe an oral examination.

(b) A candidate who fails to fulfill the requirements within the specified (i) three years for the part-time mode of study (ii) two years for the full-time mode shall be recommended for discontinuation under the provisions of General Regulation G12, except that a candidate, who is unable because of illness or circumstances beyond his control to complete the requirements within the prescribed maximum period of study, may apply for permission to extend his period of studies. Any such application shall be made within two weeks of the first day of the examination paper in question.

E17 Course selection

(a) Selection of study patterns shall be made in consultation with and be subject to the approval of the Head of the Department[3] concerned.

(b) A candidate who is permitted to select the study pattern under section (a)(ii)(1) of Regulation E16 shall select 12 modules which include a minimum of eight modules from the syllabuses of the candidate's approved field of study.

(c) A candidate who is permitted to select the study pattern under section (a)(ii)(2) of Regulation E16 shall select eight modules which include a minimum of five modules from the syllabuses of the candidate's approved field of study. Full-time mode candidates must select this study pattern.

(d) Subject to the approval of the Faculty Higher Degrees Committee on the recommendation of the Head of the Department[3] concerned, a candidate may in exceptional circumstances be permitted to select an additional module.

E18 Project report or dissertation

(a) For part-time mode of study, a candidate shall submit the title of his project report or dissertation by a date specified by the Board of Examiners. A candidate may submit his completed project report or dissertation after the successful completion of four modules but shall not submit it later than the end of April of the third academic year of his studies unless special permission is granted for this period to be extended.

(b) For the full-time mode of study, a candidate shall submit the title of his project or dissertation by a date specified by the Board of Examiners. A candidate must submit the completed project report or dissertation not later than the end of April of the second academic year of his studies unless special permission is granted for this period to be extended.

(c) All candidates enroled in any mode of study shall submit a statement that the project report or dissertation represents his own work (or in the case of conjoint work, a statement countersigned by his co-worker, which shows his share of the work) undertaken after the registration as a candidate for the degree.

E19 Examinations

(a) The written examination for each module shall be held after the completion of the prescribed course of study for that module, and not later than the January or May immediately following the completion of the course of study for that module.

(b) A candidate who has failed to satisfy the examiners in a module or modules may be permitted to present himself either for re-examination in the module or modules of failure or for examination in the same number of new modules when the examination is next held. To proceed to the following year of the curriculum, a candidate must satisfy the examiners in a minimum of two modules in each academic year. A candidate who passes in less than two modules in an academic year may be recommended for discontinuation of studies under the provisions of General Regulations G12.

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[3] The Course Co-ordinator in respect of MSc(Eng) in Building Services Engineering, the Chief Course Co-ordinator in MSc(Eng) in Computers in Manufacturing, and the Programme Director in MSc(Eng) in Internet Computing and in Electronic Commerce.

(c) A candidate who has presented an unsatisfactory project report or dissertation may be required to submit a revised project report or dissertation on the same subject within a specified period.
(d) A candidate who has presented an unsatisfactory project report or dissertation for a second time shall be recommended for discontinuation of studies under the provisions of General Regulation G12.
(e) A candidate who has failed to submit a satisfactory project report or dissertation within the prescribed maximum period of study, including any extension, shall be recommended for discontinuation of studies under the provisions of General Regulation G12.

E20 Examination results

At the conclusion of the examination and after presentation of the project reports or dissertations, a pass list shall be published. A candidate who has shown exceptional merit at the whole examination may be awarded a mark of distinction, and this mark shall be recorded on the candidate's degree diploma.

SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN ENGINEERING[4]

MSC(ENG) IN BUILDING SERVICES ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the fields of design, management and operation of building services engineering systems.

The list below is not final and some courses may not be offered every year.

MEBS6000. Utility services

Cold and hot water supply: water distribution systems, patterns of usage, estimation of requirements, simultaneous demand, storage capacity, pumping arrangements, calorifiers and water heaters; steam systems: low and high pressure systems, boilers and heat exchangers, steam supply piping and condensate return, insulation, steam trapping; drainage systems and sewage disposal: stormwater and sanitary drainage systems, rainfall intensity, simultaneous sanitary discharge, sizing of drains and sewers, methods of sewage disposal, primary and secondary treatments; lifts, escalators and conveyors: calculation of lift requirements, electrical/mechanical details of installation, operation and maintenance, safety aspects; L.V. electrical installation; communication systems; security and alarm systems.

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[4] Candidates who have failed to satisfy the examiners for the Degree of M.Sc.(Eng.) may on termination of their study be awarded a Postgraduate Diploma in Engineering, subject to approval of the Faculty Board.

MEBS6001. Supply and utilization of electrical energy

Supply rules: I.E.E. regulations; standards and codes of practice; supply systems; H.V. and L.V. supplies; distribution in buildings; earthing and bonding arrangements; overcurrent and fault protection; installation design; standby generators; uninterruptible power supplies; power factor correction and tariff; electrical safety. Distribution transformers; switchgear and fuses; motor control gear; factory built assemblies; safety interlocks; selection of electrical equipment and conductors. Electric drives; electronic equipment; electromagnetic interference; lightning protection.

MEBS6002. Lighting engineering

Lighting physics; vision and light measurements; human perception; photometry and spectrophotometry; colorimetry; calculations of photometric data; glare; guidelines for lighting design; use of tables, charts and nomograms. Light production; artificial light sources and luminaries; daylighting; interior lighting; exterior lighting; colour rendering; utilization factors; polar curves; British Zonal system; lighting for safety; lighting for workplaces.

MEBS6003. Management and contract organization

Tendering procedure, contract documents and contract strategy; project planning, scheduling and control; employees' compensation act, insurance and safety. Management and organization theory and practice; human resources development; motivation; leadership; organization structures; quality management; meetings; communication. Decision making and evaluation methods.

MEBS6004. Built environment

External environment: human factors, climatology; internal design criteria; thermal environment (heat): insulation for energy conservation, heat transmission, e.g. solar contribution; visual environment (light): eye and vision, light production, levels of illumination; aural environment (sound or noise): noise criteria for buildings, sources of noise and vibration, noise and vibration control; functional requirement of buildings.

MEBS6005. Building automation systems

Principles of building automation systems: system configurations; central processor and outstations; distributed processing and intelligence; integrated control; control modes; direct digital control; adaptive control; tuning; types of input and output points; security and energy management. Microprocessor fundamentals: architecture of microprocessor systems; computerized logic control; memories; special supporting devices; hardware and software development; system development. Transducers, sensors and actuators: signal conditioning, processing and transmission. Current developments; selection criteria; cost, reliability and system maintenance.

MEBS6006. Environmental services I

Different forms of energy supply to buildings: electricity, fuel oil, solar; heating and cooling systems: pyschrometry, thermal comfort, heating and cooling load estimation, boilers, furnaces and other heating

devices, associated equipment including piping, ducting work; refrigeration; air conditioning and ventilation: fresh air requirement, air contamination, fume and dust removal, air conditioning system design, control devices.

MEBS6009. Fire services design (2 modules)

Characteristics and behaviour of fire; fire hazards of materials and buildings; fire hazards of building services and processes; fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, hydrant and hosereel systems, drencher systems; gas-based fire extinguishing systems: BTM, BCF, and $C0_2$ systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; smoke control; staircase pressurization; smoke vents; emergency power; statutory regulations governing fire services installations: F.O.C. rules, N.F.P.A. codes and local Codes of Practice; installation and commissioning; maintenance requirements.

MEBS6008. Environmental services II

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

MEBS6014. Computer modelling and simulation

Mathematical modelling: modelling of systems; subsystems and components, deterministic and stochastic modelling, steady-state and dynamic modelling, model format, accuracy and validation, applications to thermofluid systems for design, performance evaluation and economic analysis.

Computer simulation: computer implementation of simulation models, simulation methods by successive substitution and Newton-Raphson approach for univariate and multivariate problems, steady-state simulations for system analysis at off-design conditions, dynamic simulations for transient analysis, techniques for simulation of large systems and use of modular computer simulation packages.

MEBS6013. Testing and commissioning

The commissioning process: design provisions, specification, documentation, planning and management, contractual responsibilities; setting to work; measurement methods: fundamentals, instrumentation, calibration, methodology, sources of error; balancing of fluid networks: Ma's method, Harrison and Gibbard's method, tolerances; performance testing; post construction evaluation.

MEBS6010. Indoor pollution

Concept of occupant exposure: thermal, visual, acoustic and air quality stressors; stress, strain, susceptibility and adaption; types and physiological effects of indoor contaminants: gases and vapours, inert particulates,

biological particulates, and radionuclides; psychophysiological factors; sources and location of pollutants: micro-, mini-, meso- and macro-environments; measurement methods for indoor pollutants; methods of pollution control: design of passive and active systems, operation and maintenance; legislation and public policy issues; energy and cost implications of indoor pollution control.

MEBS6011. Maintenance and management of building facilities

Areas of facilities management; security of facilities; maintenance philosophy; optimum control and operation; fault detection and analysis; energy management; safety and environmental protection. Management techniques in maintenance: decision making techniques; spares inventory control; types of maintenance techniques; resource management; computerized maintenance; measures of maintenance effectiveness; design of management instruments. Plant availability and maintainability; reliability of parallel and series configurations.

MEBS6012. Project (4 modules)

MSC(ENG) IN COMMUNICATION ENGINEERING

Core Courses

Each candidate is required to follow a prescribed course of study consisting of 12 modules for getting a master degree. At least six of the 12 modules have to be selected from the list of **Core Courses**. Students can also select to undertake a project and eight modules of which five have to be selected from the list of **Core Courses**. The list below is not final and some courses may not be offered every year. Candidate will be required to do the coursework in the respective courses selected. The course code and course titles for the **Core Courses** are listed as follows.

ELEC6005	DSP applications in communications
ELEC6006	Communications policy and regulations
ELEC6014	Data communications
ELEC6026	Advanced digital signal processing
ELEC6030	Speech analysis and processing
ELEC6040	Mobile radio communications
ELEC6043	Digital image processing
ELEC6044	Advanced communication network
ELEC6045	Spread spectrum systems
ELEC6051	Advanced topics in communication theory and systems
ELEC6063	Optoelectronics and lightwave technology
ELEC6065	Data compression
ELEC6069	Multimedia storage system
ELEC6071	Mobile data network

The non-core courses can be selected from the list of MSc courses in the Department of Electrical and Electronic Engineering and some of the MSc courses in the Department of Computer Science and Information Systems, or from the MSc courses offered by other departments of the Faculty of Engineering subject to approval.

SYLLABUSES FOR THE CORE COURSES

ELEC6005. DSP applications in communications

Source coding techniques: signal decorrelation, quantization, entropy coding; Image, video, audio and speech coding. Adaptive Filtering Algorithms and Applications: adaptive filtering algorithms, channel equalization, echo cancellation. Implementation of digital signal processing algorithms.

ELEC6006. Communications policy and regulations

Radio frequency management, allocation of spectrum, regulations for spectrum use, common carriers, Satellite and cables, competition and compliance, ITU, long term policy planning.

ELEC6014. Data communications

Transmission and modulation systems, modems, coding techniques. Data terminals, line control, the communications interface, concentrators and multiplexers. Distributed intelligence, message and packet switching, data communication systems.

ELEC6026. Advanced digital signal processing

One and two dimensional discrete-time signals and systems; analysis and design of digital filters, implementation issues; waveform coding; spectral analysis; adaptive signal processing; multirate signal processing; signal processing algorithms and system architecture; applications of digital signal processing.

ELEC6030. Speech analysis and processing

Models for speech signals; coding and storage of speech; short-time frequency domain techniques; linear predictive coding; speech synthesis; speech recognition; application case studies.

ELEC6040. Mobile radio communications

Introduction to mobile radio communications; statistical communication theory; elements of mobile radio communication systems; error performance over radio links; cellular systems; elements of cellular systems design; the digital cellular systems and the future systems.

ELEC6043. Digital image processing

Image modelling; sampling principle; image devices; two-dimensional operators and transforms; image filtering, sharpening, noise cleaning; multiple image operations; coding and restoration; feature extraction; representation, description, supervised and unsupervised classification; 3D vision; rule-based image analysis, motion analysis; case studies.

ELEC6044. Advanced communication network

Queuing theory, teletraffic engineering; digital switching systems; communication network design techniques; high speed networks; network performance and management.

ELEC6045. Spread spectrum systems

Introduction; direct sequence; frequency/time hopping and hybrid systems; characteristics, anti-jam, multiple access; generation and detection of spread spectrum signals; applications to secure communications, digital cellular mobile systems.

ELEC6051. Advanced topics in communication theory and systems

This course aims at offering an in-depth view of some research topics of current interest in the field of communication theory and systems.

ELEC6063. Optoelectronics and lightwave technology

Optical materials engineering, optical devices – waveguide/switches, lasers and LED, and optoelectronic IC, photonic switching systems – supper capacity/speed, and multi-media technology applications – ATM and broadband ISDN.

ELEC6065. Data compression

Lossless compression, image compression, video compression, audio compression, coding standards.

ELEC6069. Multimedia storage system

Basic characteristics of multimedia data, compression standards, storage organizations, disk scheduling, data migration, and cache replacement.

ELEC6071. Mobile data network

Overview of existing mobile networking services and technologies; requirements and challenges for mobile data network design; access technologies; mobility management; mobile data network security; emerging mobile data architectures and services; mobile data applications.

ELEC6021. Project (4 modules)

MSC(ENG) IN COMPUTER AND INFORMATION TECHNOLOGY

Core Courses

Each candidate is required to follow a prescribed course of study consisting of 12 modules for getting a master degree. At least six of the 12 modules have to be selected from the list of **Core Courses**. Students can also select to undertake a project and eight modules of which five have to be selected from the list of **Core Courses**. The list below is not final and some courses may not be offered every year. Candidate will be required to do the coursework in the respective courses selected. The course code and course titles for the **Core Courses** are listed as follows.

ELEC6007	Advanced computer network
ELEC6008	Pattern recognition
ELEC6031	Numerical methods for computer application
ELEC6036	High-performance computer architecture
ELEC6040	Mobile radio communications
ELEC6043	Digital image processing
ELEC6048	Neural computing
ELEC6050	Advanced topics in computer engineering and applications
ELEC6062	Scalable parallel computing
ELEC6065	Data compression
ELEC6069	Multimedia storage system
ELEC6070	Cryptography and network security
ELEC6071	Mobile data network
CSIS7302	Embedded system and pervasive computing

The non-core courses can be selected from the list of MSc courses in the Department of Electrical and Electronic Engineering and some of the MSc courses in the Department of Computer Science and Information Systems, or from the MSc courses offered by other departments of the Faculty of Engineering subject to approval.

SYLLABUSES FOR THE CORE COURSES

ELEC6007. Advanced computer network

Overview of computer network, fibre optics, cell networking, ATM, technologies of cell networking, gigabit packet networks, design and performance issues of gigabit networking, and wireless communication networking.

ELEC6008. Pattern recognition

Bayes decision theory; parametric and non-parametric techniques; linear discriminant functions; unsupervised training and clustering; feature extraction; neural network techniques; structural recognition techniques; miscellaneous methods and applications.

ELEC6031. Numerical methods for computer application

General principles of computer application; accuracy and error analysis; series and functions; linear algebra; nonlinear equations; finite differences applied to interpolation, integration and differentiation; special topics in optimization, Monte Carlo method or Fourier methods.

ELEC6036. High-performance computer architecture

Introduction to high-performance model computers; pipelining and instruction-level parallelism; memory-hierarchy design; interconnection networks; multiprocessors; case studies.

ELEC6040. Mobile radio communications

Introduction to mobile radio communications; statistical communication theory; elements of mobile radio communication systems; error performance over radio links; cellular systems; elements of cellular systems design; the digital cellular systems and the future systems.

ELEC6043. Digital image processing

Image modelling; sampling principle; image devices; two-dimensional operators and transforms; image filtering, sharpening, noise cleaning; multiple image operations; coding and restoration; feature extraction; representation, description, supervised and unsupervised classification; 3D vision; rule-based image analysis, motion analysis; case studies.

ELEC6048. Neural computing

Conventional statistical pattern recognition: Bayes decision theory; basic neural network: the perceptron, iterative learning; networks with hidden layers: decision regions, backpropagation learning, convergence and speeding up algorithms; other models: the radial basis function network, the ART network, the self-organizing neural map, etc.; applications: speech and pattern recognition, functional approximation; VLSI and optical implementation.

ELEC6050. Advanced topics in computer engineering and applications

This course aims at offering an in-depth view of some research topics of current interest in the field of computer engineering and applications.

ELEC6062. Scalable parallel computing

Commodity microprocessors, high-performance networks, symmetri multi-processor, clusters of PC/workstations, massively parallel processors, scientific and commercial applications, distributed multi-media and scalable computing.

Prerequisite: Year 3 or postgraduate students

ELEC6065. Data compression

Lossless compression, image compression, video compression, audio compression, coding standards.

ELEC6069. Multimedia storage system

Basic characteristics of multimedia data, compression standards, storage organizations, disk scheduling, data migration, and cache replacement.

ELEC6070. Cryptography and network security

This course focuses on the mathematical concepts and techniques behind the state-of-the-art information encryption and network security technologies. Also covered are the security threats and their possible countermeasures, secure protocols, and other network security related schemes (authentication, key management, etc.).

ELEC6071. Mobile data network

Overview of existing mobile networking services and technologies; requirements and challenges for mobile data network design; access technologies; mobility management; mobile data network security; emerging mobile data architectures and services; mobile data applications.

CSIS7302. Embedded system and pervasive computing

The course offers practical knowledge needed in embedded system development. Industry and research projects will be discussed to show how human life can be benefited from pervasive computing. Topics include wearable computer architecture and applications; sensor networks; real-time embedded operating systems; embedded servers; embedded system networking; address-free routing; smart spaces; dynamic service discovery; mobility and case studies.

ELEC6021. Project (4 modules)

MSC(ENG) IN COMPUTERS IN MANUFACTURING

The Curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in Computers in Manufacturing.

The list below is not final and some courses may not be offered every year.

MECH6031. Computer automated inspection

Mechanical gauging; coordinate measuring machine; tactile sensors; electromagnetic sensing; optical gauging and profiling; surface roughness inspection; image acquisition and storage; lighting and optical system; image processing and understanding; location and range extraction; 2-D and 3-D representation; pattern recognition and decision making; speckle metrology.

MECH6029. Computer-aided design applications

Design analysis of problems; finite element applications in design, stress analysis, heat transfer, vibration problems in design and solutions by computer packages; optimization in design; case studies.

CIMA6001. Geometric modelling and computer graphics

2D, 3D geometric modelling principles: information representation and manipulation, mathematical bases, graphics rendering techniques; elements of computer graphics; graphics packages and standards; data exchange standards.

MECH6030. Computer control for manufacturing processes

Structure of process control computers; interface; z-transform, sampling theory; discrete-time models; stability analysis; discrete controller design; optimal control; state space representation and controller design; parameter estimation; self-tuning controllers; control applications.

CIMA6003. Computer-aided optimization and control of manufacturing Systems

Modelling of manufacturing systems and parameter estimation; theory and computer implementation of static and dynamic optimization; hill-climbing techniques; linear-quadratic optimization and control; dynamic programming; integrated control system and plant design.

CIMA6004. Computer-aided manufacturing

Numerical control principles and applications; computer aided process planning; industrial robots; flexible manufacturing systems; computer aided production management; computer aided process control and quality control; applications of AI in manufacturing; CAD/CAM evaluation and implementation; computer integrated manufacturing (CIM).

IEIM6005. Flexible manufacturing systems

Types of FMS. FMS specification. General structure of FMS. Materials handling systems. Machining loading/unloading and workpiece transfer. Tool management systems. Applications of NC machines and industrial robots. In-process and post-process gauging. System control and scheduling of FMS. Analytical modelling. Applications of computer simulation models.

IEIM6006. Automated assembly

Design for assembly. Parts handling and feeding. Robotic assembly: assembly robots, gripper design, robot sensing, mating of parts, programming languages. Flexible assembly systems. Economic justification for automated assembly. Man-machine interaction in automated assembly systems.

IEIM6007. Advanced electronic manufacturing technology

PCB material and fabrication process; surface mount technology and modern assembly techniques; semi-automatic and robotic assembly; mass soldering technology; inspection techniques; statistical process control; facilities layout; MRP II and JIT applications; CAD equipment and CAM capability; quality manual and ISO 9000; cost considerations; regional manufacturing environment; new developments; roadblocks to development.

CIMA6008. Computer-aided design of integrated circuits

System specifications and behavioural synthesis; floor planning; placement; routing; compacting; behavioural, logic-level, switch-level and circuit-level simulation; critical path analysis; automatic test generation; fault simulation; design rule checking; netlist-versus-layout; logic synthesis; module generation; special hardware; parallel algorithms.

CIMA6009. Industrial robotics

Flexible automation; industrial manipulator features and development; kinematics and dynamics; drive systems; end-effectors; robot sensors; robot intelligence; trajectory planning; levels and methods of control; interfacing and communication; usage considerations; operational environments.

CIMA6010. Mechatronics

Introduction to mechatronics; electromechanical system representation and performance; digital processing and control functions; motor drives, actuators and transducers; electronic power amplification and conditioning; microprocessor-based servocontrol of machine motion; programmable sequence controllers; computer-aided motion controller design; man-machine interfacing technology.

CIMA6011. Pattern recognition

Bayes decision theory; parametric and non-parametric techniques; linear discriminant functions; unsupervised training and clustering; feature extraction; miscellaneous recognition techniques.

CIMA6012. Computer communications

Transmission and modulation systems, modems, coding techniques; data terminals, line control, the communications interface, concentrators and multiplexers; distributed intelligence, message and packet switching, data communication systems.

CIMA6013. Microprocessors and interfacing

Microprocessor organizations; memory subsystems; I/O techniques; magnetic recording techniques; CRT-terminals; coprocessors; multiprocessor and multiple microcomputer systems, application case studies.

ELEC6043. Digital image processing

Image modelling; sampling principle; image devices; two-dimensional operators and transforms; image filtering, sharpening, noise cleaning; multiple image operations; coding and restoration; feature extraction; representation, description, supervised and unsupervised classification; 3D vision; rule-based image analysis, motion analysis; case studies.

MECH6001. Advanced design methods and applications

Engineering design, design theory and methodology: e.g., axiomatic design, optimization design, design for manufacturability, and design for assembly.

CIMA6014. Project (4 modules)

MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education and training in the theory and techniques of Electronic and Computer Engineering.

The list below is not final and some courses may not be offered every year.

ELEC6001. Advanced topics in electric drives and control

Selected topics from the latest development in the areas of electric drives and control.

ELEC6002. Advanced electric vehicle technology

Selected topics from the latest development in the areas of electric vehicle technology.

ELEC6003. Advanced power electronics

High Frequency switching converters. Dynamics and Control of switching converters. Modelling of switching converters. Components and devices. Industrial requirements.

ELEC6004. Railway engineering and application

Selected topics from recent developments in areas of signalling, train control and protection systems, AC and DC traction systems, AC and DC electrification systems, train performance modeling and simulation, electromagnetic compatibility disturbance sources and susceptibility, auxiliary power supplies, installing and commissioning, and related areas.

ELEC6005. DSP applications in communications

Source coding techniques: signal decorrelation, quantization, entropy coding; Image, video, audio and speech coding. Adaptive Filtering Algorithms and Applications: adaptive filtering algorithms, channel equalization, echo cancellation. Implementation of digital signal processing algorithms.

ELEC6006. Communications policy and regulations

Radio frequency management, allocation of spectrum, regulations for spectrum use, common carriers, Satellite and cables, competition and compliance, ITU, long term policy planning.

ELEC6007. Advanced computer network

Overview of computer network, fiber optics, cell networking, ATM, technologies of cell networking, gigabit packet networks, design and performance issues of gigabit networking.

ELEC6008. Pattern recognition

Bayes decision theory; parametric and non-parametric techniques; linear discriminant functions; unsupervised training and clustering; feature extraction; neural network techniques; structural recognition techniques; miscellaneous methods and applications.

ELEC6014. Data communications

Transmission and modulation systems, modems, coding techniques. Data terminals, line control, the communications interface, concentrators and multiplexers. Distributed intelligence, message and packet switching, data communication systems.

ELEC6025. Industrial digital control

Microcomputer control. Discrete modelling. System analysis. Conventional and optimal controller design. Parameter and state estimation. Adaptive control principles. Micro-controller implementation.

ELEC6026. Advanced digital signal processing

One and two dimensional discrete-time signals and systems; analysis and design of digital filters, implementation issues; waveform coding; spectral analysis; adaptive signal processing; multirate signal processing; signal processing algorithms and system architecture; applications of digital signal processing.

ELEC6027. Fundamentals of integrated systems design

IC design route and technology considerations; logic and circuit design with MOS and CMOS: data and control flow in systematic structures; systems design and design methods; computer aids to IC design; application case studies.

ELEC6028. Robotics

Robot types; manipulator mechanism and kinematics; actuators; sensors; control; robot programming and application case studies.

ELEC6030. Speech analysis and processing

Models for speech signals; coding and storage of speech; short-time frequency domain techniques; linear predictive coding; speech synthesis; speech recognition; application case studies.

ELEC6031. Numerical methods for computer application

General principles of computer application; accuracy and error analysis; series and functions; linear algebra; nonlinear equations; finite differences applied to interpolation, integration and differentiation; special topics in optimization, Monte Carlo method or Fourier methods.

ELEC6032. Process and device design for VLSI circuits

Design of submicron MOS and bipolar devices; scaling schemes and their related problems; introduction to process and device simulation tools; capabilities and limitations; methodology in process and device developments; case study of a typical IC process; advanced IC technologies.

ELEC6033. Computerized power system control

Selected topics from recent developments in power applications of computerized or microprocessor-based control, including power plant control, transmission and distribution control, and stability control issues.

ELEC6034. System identification and estimation

Nonparametric time-domain and frequency-domain methods; correlation and spectral analysis; periodogram; lag windows. Parameter estimation methods. Linear regression; least-squares estimation. Auto regressive moving average models. Prediction error methods; maximum likelihood. Instrumental variable methods. Recursive identification methods. Real- time identification. Extended Kalman filter. Design of identification experiments; choice of input signal and sampling interval. Identification of systems in closed-loop operation. Model validation and model structure determination.
Applications and case studies.

ELEC6035. Computer system architecture

Levels of abstraction and notations; basic structures of a computer system; CPU organisation: control unit, hardwired control unit, microprogrammed control unit; ALU; memory system architecture; powerful CPU design; I/O organisation; RISC vs CICS; case studies.

ELEC6036. High-performance computer architecture

Introduction to high-performance model processors; pipelining and instruction-level parallelism; advanced pipelining design: scoreboard and Tomasulo algorithm; speculative execution (branch prediction supported by reorder buffers); advanced technologies: value prediction, instruction reuse; advanced computing model: quantum computing; low-power processor design (e.g., Transmeta's Crusoe processors); case studies (e.g., IA-64)

Prerequisite: ELEC1623 Computer micro-architecture and system software interfacing or ELEC2401 Computer architecture (for undergraduate students only)

ELEC6040. Mobile radio communications

Introduction to mobile radio communications; statistical communication theory; elements of mobile radio communication systems; error performance over radio links; cellular systems; elements of cellular systems design; the digital cellular systems and the future systems.

ELEC6041. Machine vision

Human and machine vision overview; lighting and optical systems; image acquisition and storage; processing and analysis system; special computational architecture; task identification; inspection requirements; 2-D and 3-D representation; geometry, location and range extraction; image understanding, decision and control.

ELEC6042. Computational algorithms for physical VLSI

Physical VLSI design methodologies; design rule verification, layout compaction; automatic placement and routing; floorplanning and parallel algorithms.

ELEC6043. Digital image processing

Image modelling; sampling principle; image devices; two-dimensional operators and transforms; image filtering, sharpening, noise cleaning; multiple image operations; coding and restoration; feature extraction; representation, description, supervised and unsupervised classification; 3D vision; rule-based image analysis, motion analysis; case studies.

ELEC6044. Advanced communication network

Queuing theory, teletraffic engineering; digital switching systems; communication network design techniques; high speed networks; network performance and management.

ELEC6045. Spread spectrum systems

Introduction; direct sequence; frequency/time hopping and hybrid systems; characteristics, anti-jam, multiple access; generation and detection of spread spectrum signals; applications to secure communications, digital cellular mobile systems.

ELEC6046. Intelligent control

Introduction to AI and expert systems; foundations of knowledge engineering; knowledge representation knowledge-based control; intelligent control systems; real-time control issues.

ELEC6047. Advanced control theory

Dynamic systems; linear system theory; controller design methodologies; stability analysis; performance analysis; robust control; filtering theory; adaptive systems.

ELEC6048. Neural computing

Conventional statistical pattern recognition: Bayes decision theory; basic neural network: the perceptron, iterative learning; networks with hidden layers: decision regions, backpropagation learning, convergence and speeding up algorithms; other models: the radial basis function network, the ART network, the self-organizing neural map, etc.; applications: speech and pattern recognition, functional approximation; VLSI and optical implementation.

ELEC6049. Advanced digital system design techniques

VHDL and hardware description language; mixed-level and mixed-mode simulation techniques; logic and system synthesis; testing, fault analysis and grading, design for testability; programmable logic devices and applications; high speed digital system design.

ELEC6050. Advanced topics in computer engineering and applications

This course aims at offering an in-depth view of some research topics of current interest in the field of computer engineering and applications.

ELEC6051. Advanced topics in communication theory and systems

This course aims at offering an in-depth view of some research topics of current interest in the field of communication theory and systems.

ELEC6052. Advanced topics in control theory and systems

This course aims at offering an in-depth view of some research topics of current interest in the field of control theory and systems.

ELEC6053. Biomedical electronics and sensors systems

Biomedical technology, sensing, signal processing, control and computation. Physiological and anatomic aspects of medical monitoring and imaging.

ELEC6054. Power system dynamics

Synchronous machine modelling; load models; small-signal stability; transient stability; voltage stability; subsynchronous resonance; mid-term and long-term stability; numerical methods, direct methods, methods of improving stability.

ELEC6055. Power system distribution

Substation configuration and design; feeder design fault detection and isolation; restoration; voltage regulation; secondary circuit design; distribution system reliability analysis; distribution automation.

ELEC6056. Power system operation

Generation control; network analysis, state estimation, security optimization, optimal power flow; energy management systems: computer and communications for supervisory control and data acquisition.

ELEC6057. Power system planning

Optimal generation expansion; load forecasting; reliability evaluation; probabilistic production costing, Monte Carlo simulation; value of service; least cost planning; electricity pricing.

ELEC6058. Power transmission

High voltage a.c. transmission. Steady-state and transient performance of transmission lines. System simulation. Lightning performance. Overvoltages and insulation coordination. Reactive power control, SVC's, Field effects, corona, radio interference and noise. High voltage d.c. transmission. Thyristor valves, converter operation, harmonics and filters, protection and insulation coordination.

ELEC6059. Multicomputer network technology

Multicomputer network architecture, message routing and protocols, collective communication in MPI, wormhole-routed network and ATM network, etc. Special topics and issues in multicomputer network technology.

ELEC6060. Parallel signal and image processing

Models of parallel computation, matrix operations, numerical signal processing problems, parallel discrete Fourier transform, fast convolution and correlation, parallel image analysis and visualization, distributed sensor processing, parallel digital signal processors and selected case studies in parallelization of signal and image processing applications.

Prerequisite: 62355.
Co-requisite: ELEC6043.

ELEC6061. Advanced PC engineering

Processor engineering; memory management; multi-ported L1/L2 caches and TLBs; buses; motherboards; chipsets; SDRAM; SCSI and ATA; video cards; desktop PC packaging; mobile PC engineering.

ELEC6062. Scalable parallel computing

Commodity microprocessors, high-performance networks, symmetri multi-processor, clusters of PC/workstations, massively parallel processors, scientific and commercial applications, distributed multi-media and scalable computing.

Prerequisite: Year 3 or postgraduate students

ELEC6063. Optoelectronics and lightwave technology

Optical materials engineering, optical devices - waveguide/switches, lasers and LED, and optoelectronic IC, photonic switching & optical communications systems.

ELEC6064. Advanced topics in microelectronics

This course aims at offering an in-depth view of some research topics of current interest in the field of microelectronics.

ELEC6065. Data compression

Lossless compression, image compression, video compression, audio compression, coding standards.

ELEC6066. Advanced topics in power system engineering

To study specific topics and issues of special current interest in power system engineering.

ELEC6067. Magnetic resonance imaging (MRI) technology and applications

Fundamentals of Nuclear Magnetic Resonance (NMR); introduction to MR imaging system; design principle of permanent and super-conducting magnets; RF antennas (probes), gradient coils, RF transmitter and receivers; signal processing and imaging reconstruction; basic pulse sequence design; advanced fast imaging methods; MR spectroscopy and MR imaging applications, including functional MRI in human brain functional research and clinical applications.

ELEC6068. Advanced digital circuit design

Multiple levels of abstraction, simulation, synthesis, verification, computer-aided design.

Prerequisite: understanding of basic digital design principles.

ELEC6072. Digital communications transceiver

An introduction to the techniques of digital communications transceiver design for various types of channels. Theoretical background and practical algorithms will be introduced. It serves as an entry-level course to those interested in advance studies in the area. Introduction and preview, structure of a digital transmitter and receiver, concept of signal space and signal dimension, channel models, baseband transmission, passband transmission, Shannon's coding theorem, forward error correction coding [block and convolutional coding], modulation techniques and signal constellations [transmission for high bandwidth efficiency, transmission for high bandwidth expansion], equalization, synchronization and timing recovery, techniques to evaluate the performance of a digital transmission scheme.

ELEC6021. Project (4 modules)

MSC(ENG) IN ELECTRONIC COMMERCE[5]

For the part-time mode, the curriculum shall normally take two calendar years of study. It provides an understanding of the use of Internet technologies to globalize business opportunities and operations.

A candidate shall study 8 modules (of one module each) and a Project (of 4 modules) or 12 modules. A minimum of 5 modules shall be from the list below, and not more than 3 modules may be from the syllabuses for MSc(Eng) Internet computing if candidates opt for taking 8 modules and a Project. A minimum of 8 modules shall be from the list below, and not more than 4 modules may be from the syllabuses for MSc (Eng) Internet computing if candidates opt for taking 12 modules. The list below is not final and some courses may not be offered every year.

SYLLABUSES

ECOM6001. Internet and the WWW

This module covers the fundamentals of the essential components and technologies that are part of today's Internet, and the basic concepts that underlie the operation and the proliferation of the World Wide Web. Internet topics include TCP/IP, DNS, network infrastructures, and emerging technologies. World Wide Web topics include Web architecture, client/server operations, HTML and other ML's, and Web security.

ECOM6004. Legal aspects of I.T. and e-commerce

This module provides an introduction to some of the main legal problems generated by recent developments in information technology and e-commerce, and their possible solutions. Topics to be covered include copyright, patent protection for software and business methods, domain name disputes and other intellectual property issues on the Internet, contractual issues of on-line trading, public key infrastructure and electronic transactions, privacy and data protection, and computer crimes. If time permits, the situation in the People's Republic of China will also be covered.

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[5] This programme and syllabus are for students admitted to the first year of study for the degree of MSc(Eng) in Electronic Commerce in the 1999-2000 academic year.

ECOM6006. Business transformation and process re-engineering

This module aims to provide a broad perspective about the key issues facing the effective planning, implementation, and management of information technologies for the transformation of business and operation to create value and competitive advantages. Special focus will be on the analysis of how electronic commerce can play an important role in process reengineering and business transformation.

ECOM6008. Supply chain management

The objectives of this course are to provide participants with: (a) an understanding of the impact of supply chain management and related issues on the success and profitability of the modern organization; (b) the major challenges faced in implementing an integrated supply chain management strategy, as well as approaches for meeting these challenges; (c) the analytical and problem-solving skills necessary to develop solutions for a variety of logistics and supply chain problems; (d) the basic understanding about the application and the development of logistics and supply chain technology in Hong Kong industries.

ECOM6010. Strategic management of technology and innovation

This course is designed to provide students with a broad perspective about the key issues facing the effective management of technology in today's fast-changing, competitive, global environment. Drawing upon research over the last several decades, we will try to separate some of the facts from myths about what we do and do not know about the effective management of technology and innovation. We will also explore how fast changing information technologies such as the Internet might be transforming some of the social/economic dynamics of product/service developments and innovations. The course aims to help students develop an understanding about the nature of technological work and the knowledge system in technology. From this basic understanding we will examine the role of technology in business strategy, and gain insight about the key factors affecting product development success or failure through various case discussions and review of empirical research findings.

ECOM6012. E-commerce and the network economy

The objective of this module is to provide insight in how e-commerce plays a pivotal role in the emergence of the new network economy through business cases. It covers cases in the new business paradigm, the Internet market space, e-commerce in Hong Kong and China, e-payment and security solutions, supply chain management, customer relationship management, intra-organizational e-commerce, B-to-B and B-to-C e-commerce, establishing trust and managing regulatory harmonization.

ECOM6013. E-commerce technology

This module provides an overview of the technologies used in electronic commerce. These include (but not limited to) networking, object-oriented technology, computer and network security, databases, multimedia computing, search engine, data mining, intelligent agents.

ECOM6014. E-marketing

With the rise of the Internet and other new media, it has transformed the landscape of marketing. Recent surveys confirm that many people are now spending more time in front of a web browser than the television and this observation is spreading across different age groups. Marketing and advertising on the Internet and through other digital media is still more an art than a science although increasingly we know some solutions don't work well (e.g., spamming). Questions such as what is an effective way to advertise on the Web, how to lock in customers, how to build brand loyalty and what is the right mix of cross-media marketing are still not fully understood.

ECOM6015. Digital asset management

This module covers a range of technologies dealing with the decomposing, tagging, classifying, archiving, retrieving, filtering, structuring, and distributing of digital assets utilizing integrated digital asset management systems. The construction, use, reuse, retargeting, manipulation and transformation of alternative logical collections of digital assets and repositories are presented, as are tools to analyze assets in various types of repositories. In particular intellectual property, digital rights management and case studies are stressed.

ECOM6016. Electronic payment systems*

This module deals with technology and computer systems for managing and handling payments across electronic networks. It covers topics on payment gateways, clearance, credit card transactions, digital cash, micro-payments, authenticity, integrity, intermediaries and risk management.

ECOM6017. Human computer interaction*

This course is concerned with the design of the interaction between people and computers with particular emphasis on World Wide Web interaction. It is intended to give a comprehensive overview of the key issues of human-computer interaction (HCI) design, how the discipline evolved prior to the introduction of the Web, how HCI research is applicable to Web design, and key issues expected in the future. Students will come away from the course with the ability to identify issues and tradeoffs in interaction design, and to invent and evaluate alternative solutions to design problems. These abilities will be directly applicable to the design of Web sites that require a high level of user interactivity such as e-commerce sites.

ECOM6019. Convergence and the Development of digital content – strategic issues

In a world of multiple digital channels where one of the few common denominators is IP-based communication, technological and market convergence is making itself felt by those working with digital content, whether they be Web portals, broadband and digital television operators or mobile telephony companies.

In the past, when a new distribution channel emerged, the response was to develop a dedicated production and distribution infrastructure for that channel. The traditional response is no longer adequate. Delivering new media and services to a plethora of information and communication devices requires new ways of creating, manipulating, delivering and presenting content.

Based on examples of best practice around the world, this module addresses selected issues facing the digital content industry with the objective of providing IT professionals with a methodological grounding to better understand those working on the development and marketing of new digital services.

ICOM6005. Smart card technology and applications*

This module provides an introduction to smart card technology and how to use the technology for applications. An overview of different types of smart card will be followed by a discussion of smart card applications in e-commerce, healthcare, transportation, and national identification. The module provides the detailed information on card architecture, standards, and development tools. The system level information, card programming, and Java card technology are also covered. Security, privacy, card management and application design are discussed. In addition, case studies on smart cards are also provided, particularly with a couple of examples from Hong Kong. Finally, future trends in smart card research, development, and deployment are discussed.

ECOM6009. Project

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*cross-listed in the both ECom and IComp curriculum

MSC(ENG) IN ENVIRONMENTAL ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the field of Water and Environmental Engineering. A candidate is permitted to proceed on a course of study under E16(a)(ii)(2) of the MSc(Eng) Regulations. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses may not be offered every year.

(A) At least FIVE modules from the following list of courses or courses approved by the Department of Civil Engineering:

CIVL6005. Advanced techniques of hydrological modelling and prediction

Time series analysis; hydrological forecasting; artificial neural networks in hydrology; chaos in hydrological time series.

CIVL6006. Advanced water and wastewater treatment

Water/wastewater characteristics and standards; coagulation/flocculation; sedimentation and filtration; membrane separation; adsorption; chemical oxidation; disinfection; biological organic and nutrient removal.

CIVL6010. Coastal hydraulics and sedimentation

Tides and tidal currents; basic numerical techniques in mathematical models of tidal hydraulics and solute transport; tidal flushing and mariculture management; coastal sedimentation; impact of man-made changes on the coastal environment.

CIVL6023. Environmental chemistry

Water chemistry; air pollution chemistry; hazardous wastes; environmental chemical analyses.

CIVL6024. Environmental hydraulics

Effluent disposal; environmental transport phenomena in receiving waters; turbulent diffusion; jets and plumes; mixing in rivers and coastal waters; determination of assimilative capacity.

CIVL6025. Environmental impact assessment of engineering projects

Environmental impact assessment process; methodologies to assess environmental impacts on water, air, and land; environmental management; case studies, e.g. on transportation projects, environmental control facilities and reclamation works.

CIVL6029. Groundwater hydrology

Review of groundwater flow through porous media; geotechnical applications; contaminant transport; hydrodynamic dispersion; diffusion; geochemical retardation and subsurface pathway analysis as applied to hazardous waste disposal.

CIVL6034. Municipal wastewater treatment

Municipal wastewater flows and characteristics; sewerage systems; preliminary, primary and secondary treatment processes; wastewater disinfection; advanced treatment for nutrient removal; sludge processing and disposal.

CIVL6040. Solid and hazardous waste management engineering

Resource use in modern society; sources, characteristics, and quantities of waste; environmental impact; waste prevention, reduction, and recycling; collection, transfer and transport; mechanical, biological, chemical and thermal processing; final disposal; case studies.

CIVL6050. Urban hydrology and hydraulics

Rainfall-runoff; hydrograph prediction; flood routing; storm sewer and culvert hydraulics; storage concepts; control structures; outfall design and construction; river restoration.

CIVL6051. Water quality modelling

Mass balance and transport; particle phenomena and biochemical processes in natural and engineered environment; eutrophication; dissolved oxygen and algal dynamics; sediment-water interactions; toxics modelling; application to rivers and estuaries.

CIVL6053. Wind engineering

Statistical description of wind, parent and extreme wind data, wind profiles, wind effects on buildings and structures, wind pressures, quasi-steady approach, wind-induced vibration, dampers, codification of dynamic effects, wind effects on building ventilation, pedestrian-level wind environment, wind effects on pollutant dispersion, wind tunnel techniques.

CIVL6061. Special topic in environmental engineering A

This course provides an opportunity for students to study in-depth an area of environmental engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6062. Special topic in environmental engineering B

This course provides an opportunity for students to study in-depth an area of environmental engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001. Project (4 modules)

On admission to the programme, students will undertake a supervised project which will be assessed. The project normally extends over not less than two and not more than three academic years of study. The project must relate to the subject matter and be agreed by the Department of Civil Engineering. In addition to satisfying MSc(Eng) Regulations E 18 and E 19, the progress of the project work will be assessed for the purpose of General Regulations G 11 and G 12 according to the following scheme:

(a) to submit by January 31 in the first academic year of study a tentative title, an outline and an inception report on the project,

(b) to submit by September 30 in the second academic year of study a written report on the preliminary findings of the project, and

(c) to submit a draft dissertation not less than four months prior to the submission of the final version of dissertation.

Failure to satisfy the examiners in the above project milestones shall be considered as unsatisfactory performance or progress under the provisions of General Regulation G 11.

The final assessment of the project study shall be by an oral presentation AND a dissertation. Students are REQUIRED to give an oral presentation on the findings of their project studies in the form of a seminar at a time agreed by the Department of Civil Engineering but not later than two months prior to the submission of the dissertation. Failure in the oral presentation may lead to a failure in the project study as a whole.

MSC(ENG) IN GEOTECHNICAL ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the field of Geotechnical Engineering. A candidate is permitted to proceed on a course of study under E16(a)(ii)(2) of the MSc(Eng) Regulations. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses may not be offered every year.

(A) At least FIVE modules from the following list of courses or courses approved by the Department of Civil Engineering:

CIVL6004. Advanced soil mechanics

Soil behaviour; stresses and strains in soil masses; stress path; soil deformation and consolidation theory; soil strength and failure criteria of soils; soil modelling techniques; earth pressure; laboratory testing applications.

CIVL6022. Engineering geology

Geology and ground profiles; engineering classifications and properties of rocks and soils; geological aspect of ground investigation; engineering geological mapping; rainfall and hydrogeology; structural geology; Karst formation; engineering geophysics; geohazard; engineering geology in construction; ground movement.

CIVL6027. Foundation engineering

Introduction to foundation engineering; shallow foundations; bearing capacity; stress distribution and settlements; deep foundations; pile installation and construction control; pile load tests; inspection of deep foundations; foundation on slopes.

CIVL6028. Ground improvement

Soil treatment and ground improvement; compaction and consolidation; shallow and deep mixing; hydraulic modification; physical and chemical treatment; electro-osmosis; grouting; applications of geosynthetics in geotechnical engineering: separation, filtration, drainage and reinforcement.

CIVL6030. Landslip prevention

Soil and rock mechanics; slope stability evaluation; case histories of landslip in Hong Kong; landslip investigations; landslip prevention measures; slope maintenance; quantitative risk assessment; slope information system.

CIVL6035. Highway pavement engineering

Traffic loading; subgrade properties; soil stabilization; bituminous materials; flexible pavement design; rigid pavement design; pavement maintenance and upgrading; pavement management systems.

CIVL6036. Probabilistic methods in geotechnical engineering

Introduction to probability theory; Bayesian methods and subjectivity; methods for site investigation and design parameters; probabilistic design; risk; QRA method and application.

CIVL6038. Rock mechanics

Rock mass classification; rock mass strength and deformability as a function of structural defects such as joints; faults and bedding planes; in-situ rock stresses and their measurement; ground water percolation in rock; underground excavations and rock support system design; rock slope stability analysis; rock foundations; case histories in rock engineering; numerical methods; rock joint strength parameters; rockfall control.

CIVL6039. Slope stability and earth retaining structures

Slope engineering in Hong Kong; classification of slopes and earth retaining structures; rainfall and groundwater; construction of geological models for slopes and walls; slope stability analysis methods; design of cut and fill slopes; slope construction and monitoring; slope management and maintenance; design of retaining walls; reinforced earth; soil nailing; tied-back supports; rock slope stabilization measures; surface drainage and protection.

CIVL6043. Special topic in geotechnical engineering A

This course provides an opportunity for students to study in-depth an area of geotechnical engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6044. Special topic in geotechnical engineering B

This course provides an opportunity for students to study in-depth an area of geotechnical engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6055. Site formation for building works and infrastructure development

A discussion on various aspects of the planning, design and construction of site formation works which includes, inter alia, techniques for site charaterisation, technical considerations, engineering issues regulatory requirements and lease conditions. Case histories will be used as illustrative examples for discussion and to highlight key issues.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

MSC(ENG) IN INDUSTRIAL ENGINEERING AND INDUSTRIAL MANAGEMENT

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education and training in the philosophy, methods and techniques of Industrial Engineering and Industrial Management which are appropriate to industrial and service organizations in both the private and the public sectors of communities in Southeast Asia.

The following is a list of modules offered by the Department of Industrial and Manufacturing Systems Engineering. The list below is not final and some courses may not be offered every year.

IEIM6027. Organization theory and behavioural science

Managing and managers; evolution of management theory. Planning- decision making; strategic management; strategy implementation. Organising- organisational design and structure; power and the distribution of authority; managing organisational change and innovation. Leading- motivation; leadership; teams and teamwork; communication and negotiation. Controlling- principles of effective control; operations control.

IEIM6028. Facilities design

Types of production; factory location; plant layout; materials handling and storage; group technology and cellular layouts; layout planning techniques and computer-assisted techniques; single-facility and multi-facility location problems; assignment and quadratic assignment location problems.

IEIM6037. Costing and finance

Cost terms and purposes, allocation and absorption of overheads, product costing, budgetary control and standard costing, variance analysis, cost for decision making, capital investment appraisal, risk analysis. Interpretation of published accounts, ratio analysis, sources of short term funds, management of working capital, choice of long term finance, the concept of cost of capital.

IEIM6030. Ergonomics - man-machine systems

Human factors and systems design. Physical ergonomics, anthropometry, biomechanics, physiology. Information ergonomics; human information processing, control and communication theory. Man-machine interface design, displays and controls; work design and organization.

IEIM6031. Ergonomics - working environment

Environmental factors in system design. The visual environment; glare, visual performance. Thermal environment; effects of heat and cold on performance, indices of comfort. Noise; nature and sources, subjective and objective measurement, effects of noise, control of noise, noise-induced hearing loss. Vibration and acceleration; physiological and pathological effects, human tolerance. Other environmental factors, radiation, chemical.

IEIM6032. Industrial statistics

Statistical techniques and their industrial applications: random variables, probability distributions, point estimation, interval estimation, hypothesis testing, regression analysis, analysis of variance. Experimental design: randomization, blocking, Latin squares, factorial experiments, optimal design. Statistical quality control: acceptance sampling, design of sampling plans, quality control for continuous production processes, control charts.

IEIM6034. Operational research techniques

The philosophy and methodology of Operational Research, model building, implementation and monitoring solutions. Mathematical programming and its applications. Replacement models for capital equipment items. Preventive replacement limits and group replacement for items of low capital value. Queueing theory and discrete event simulation.

IEIM6040. Plastics processing technology

Properties of plastic resins and characteristics of plastics melt. Additives. Processing theory and practice. Plastics processing methods - equipment and criteria for selection. Process control. Material selection for different product applications. Product testing.

IEIM6042. Quality management

Total quality management and its relation to just-in-time concepts. Principles and methods of quality improvement. The function of quality in terms of social and industrial needs. International quality standards, quality auditing, and corrective actions. Organisation for quality management and quality function deployment.

IEIM6001. Concurrent engineering

Product development and realization; organization and management; performance measurements; sequential versus concurrent engineering; market research and customer requirement management; innovative product design; product economics; formal design methods and techniques; product data management.

IEIM6002. Operations management

Elements of operations strategies; quantitative forecasting models; strategic decisions; planning products, processes, technologies, and facilities; selection and management of production technology; capacity planning and facility location; production planning systems; aggregate planning; master production scheduling; inventory systems; material requirement planning; shop floor planning and control; Just-In-Time manufacturing.

IEIM6003. Quality and reliability engineering

Acceptance sampling; statistical process control; control charts; high yield processes; process capability indices; preventive maintenance; on-condition maintenance; failure mode and effect analysis; series and parallel systems; the Weibull distribution; the hazard function; renewal models; accelerated life testing.

IEIM6004. Industrial project management

Elements of project management; approach to project management; project evaluation; project selection and proposal preparation; project planning and scheduling; project organization; project team and project manager; project monitoring and control; resource management; resource planning; resource allocation in project networks; multi-criteria decision making process; the analytic hierarchy process; PERT/GANTT techniques for project control and resource allocation.

IEIM6043. Information technology management

Managerial and organizational impact of information technology (IT); Lewin's force field analysis, socio-technical systems theory, and the management of IT projects. Contemporary IT topics; Internet, intranet, extranet, groupware, data mining, multimedia systems. Artificial intelligence and its applications in enterprise systems. The management of IT applications in improving the competitiveness of organizations; business process re-engineering, continuous process improvement, virtual organizing, knowledge management, IT outsourcing and frameworks for strategic information systems planning.

IEIM6044. Supply chain management

Supply chain characterization; operation objectives; distribution channels; channel design considerations; logistics network design. Inventory management; risk pooling; distribution strategies. Strategic alliances; international issues in supply chain management; coordinating product and supply chain design; customer value. Information technology; decision support systems; the value of information in supply chains. Case studies and contemporary topics on supply chain management; the beer game.

IEIM6025. Project (4 modules)

CIMA6001. Geometric modelling and computer graphics

2D, 3D geometric modelling principles: information representation and manipulation, mathematical bases, graphics rendering techniques; elements of computer graphics; graphics packages and standards; data exchange standards.

CIMA6004. Computer-aided manufacturing

Numerical control principles and applications; computer aided process planning; industrial robots; flexible manufacturing systems; computer aided production management; computer aided process control and quality control; applications of AI in manufacturing; CAD/CAM evaluation and implementation; computer integrated manufacturing (CIM).

IEIM6005. Flexible manufacturing systems

Types of FMS. FMS specification. General structure of FMS. Materials handling systems. Machining loading/unloading and workpiece transfer. Tool management systems. Applications of NC machines and industrial robots. In-process and post-process gauging. System control and scheduling of FMS. Analytical modelling. Applications of computer simulation models.

IEIM6006. Automated assembly

Design for assembly. Parts handling and feeding. Robotic assembly; assembly robots, gripper design, robot sensing, mating of parts, programming languages. Flexible assembly systems. Economic justification for automated assembly. Man-machine interaction in automated assembly systems.

IEIM6007. Advanced electronic manufacturing technology

PCB material and fabrication process; surface mount technology and modern assembly techniques; semi-automatic and robotic assembly; mass soldering technology; inspection techniques; statistical process control; facilities layout; MRP II and JIT applications; CAD equipment and CAM capability; quality manual and ISO 9000; cost considerations; regional manufacturing environment; new developments; roadblocks to development.

Some courses may not be offered every year, and candidates shall be guided in selecting courses by the Head of Department of Industrial and Manufacturing Systems Engineering.

MSC(ENG) IN INFRASTRUCTURE PROJECT MANAGEMENT

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the Management of Infrastructure Projects over their entire life cycle, i.e. from conceptualisation and feasibility studies, through financing, contract administration, design, construction, commissioning, operation & maintenance, evaluation and decommissioning. This will draw on and synergise relevant Departmental strengths in Construction Engineering and Management, Transport and Development, Environmental Engineering, Structural Engineering and Geotechnical Engineering, as well as relevant industry expertise.

A candidate is permitted to proceed on a course of study under E16(a)(ii)(2) of the MSc(Eng) Regulations. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses may not be offered every year.

(A) At least FIVE modules from the following list of courses or courses approved by the Department of Civil Engineering:

CIVL6009. Building planning and control

Buildings Ordinance and its implementation, regulations, codes of practice and practice notes; building planning process; site safety supervision and safety assurance; quality assurance of materials and construction; demolition; temporary works; drainage works; case studies.

CIVL6013. Concrete technology

Concrete mixes; quality control; in-situ strength assessment; non-destructive testing; cracks and other defects; maintenance and repair.

CIVL6014. Construction dispute resolution

Introduction to disputes, claims and methods of dispute avoidance and resolution in construction; mediation; arbitration: fundamental principles, arbitration agreement, arbitration rules, appointment of arbitrators, power and duties of arbitrators, pre-hearing proceedings, hearing, award, role of the court; other ADR (alternative dispute resolution) methods; litigation.

CIVL6015. Construction financial management

Estimating and costing; tendering strategy; productivity analysis; financial accounting; financial management; management accounting; taxation effects.

CIVL6018. Infrastructure project management techniques

Operations research and quantitative techniques in construction management; risk analysis; project feasibility analysis; lean construction; value management; supply chain management; IT aids in planning and control of construction projects; construction process re-engineering.

CIVL6019. Construction technology

Mechanisation, automation and robotics in construction processes; construction plant and equipment; temporary works; common construction materials; materials testing and quality control; quality systems; method statements.

CIVL6021. Infrastructure contracts management

Infrastructure project packaging; different types and forms of construction contracts; selection of consultants and contractors; management of the tender phase; management of design; administration of construction contracts; construction claims management.

CIVL6025. Environmental impact assessment of engineering projects

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

CIVL6030. Landslip prevention

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6035. Highway pavement engineering

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6037. Project management - human and organisational factors

Management theories; organisations structures and cultures; project management and project teams; leadership; ethics; communication; negotiations; recruitment.

CIVL6048. Planning of transport infrastructure systems

Introduction to systems engineering, urban system models, network modelling concepts and techniques, trip assignment models.

CIVL6049. Urban development management by engineering approach

Urban development process, introductory town planning; transport modelling; integration of infrastructure and service planning; optimisation and risk management; integration of planning and implementation of engineering works; urban development; project management; principles of building control; integration of theory and practice; case studies.

CIVL6055. Site formation for building works and infrastructure development

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6058. Management of infrastructure megaprojects

Public Works financing; Public-Private-Partnerships (PPPs) including BOT-type developments; selecting appropriate procurement frameworks; multi-party contractual links; co-ordinating large work packages; interface management; JVs and cross-cultural issues; critical success factors and best practices.

CIVL6059. Special topic in infrastructure project management

This course provides an opportunity for students to study in-depth an area of infrastructure project management of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6060. Operation and maintenance of building and civil engineering works

Policies, principles and practices in operation, maintenance and rehabilitation of buildings and civil engineering infrastructure such as: bridges, roadworks, marine and port works, water supply systems and sewerage schemes; and including aspects of: inspection, appraisal, materials repair methods, monitoring systems and forensic engineering.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

MSC(ENG) IN INTERNET COMPUTING[6]

For the part-time mode, the curriculum shall normally take two calendar years of study. It provides advanced education in Internet technologies.

A candidate shall study 8 modules (of one module each) and a Project (of 4 modules) or 12 modules. A minimum of 5 modules shall be from the list below, and not more than 3 modules may be from the syllabuses for MSc(Eng) Electronic Commerce if candidates opt for taking 8 modules and a Project. A minimum of 8 modules shall be from the list below, and not more than 4 modules may be from the syllabuses for MSc (Eng) Electronic Commerce if candidates opt for taking 12 modules. The list below is not final and some courses may not be offered every year.

SYLLABUSES

ICOM6005. Smart card technology and applications*

This module provides an introduction to smart card technology and how to use the technology for applications. An overview of different types of smart card will be followed by a discussion of smart card applications in e-commerce, healthcare, transportation, and national identification. The module provides the detailed information on card architecture, standards, and development tools. The system level information, card programming, and Java card technology are also covered. Security, privacy, card management and application design are discussed. In addition, case studies on smart cards are also provided, particularly with a couple of examples from Hong Kong. Finally, future trends in smart card research, development, and deployment are discussed.

ICOM6006. Internet security and applied cryptography

This module provides a foundation on the technical issues concerning Internet security and applied cryptography. It covers areas such as: protecting information using symmetric and public key cryptography; key management; trust models and public key infrastructure; system security; mobile code security; authentication and handshake protocols; digital cash and payment mechanisms.

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[6] This programme and syllabus are for students admitted to the first year of study for the degree of MSc(Eng) in Internet Computing in the 1999-2000 academic year.

ICOM6012. Internet infrastructure technologies

This module provides a quantitative, technical coverage on the components which form the infrastructure of the Internet. Topics include: IP addressing and routing architectures; standard transport and application protocols; common LAN and multi-access control schemes; operating principles and internals of network entities; web-caching and load-balancing for webserver farms; Access and Backbone network technologies. We will discuss not only how the Internet works but also its design rationale and engineering tradeoffs.

ICOM6013. Internet systems programming

This module helps the participants to develop solid background on systems and network programming in the Internet environment. It focuses on how to develop distributed applications based on services supported by the operating systems and networks. Topics include: conventional distributed programming such as sockets and RPC; modern distributed programming models such as CORBA and DCOM; network directory services and database interfacing; Web programming and scripting.

ICOM6014. Website design, development and management

This course provides comprehensive webmaster training for the participants to develop a balanced mix of skills -- conceptual problem solving, technical systems development, application design, communications and organizational interface, project management and implementation issues related to the web. The module covers web content design, development, web programming and scripting, organizational and management strategy, website maintenance support, legal and privacy issues.

ICOM6018. Multimedia computing

This module introduces various technologies and their applications to multimedia computing. Topics include: medium types; color basics; coding and data compression techniques; audio and video technologies; high-performance storage systems such as RAID; optical storage media such as CD, CD-R, DVD; copyright protection issues and techniques; digital watermarking; multimedia databases and information retrieval; multimedia authoring tools and industrial standards such as JPEG, MPEG, RealMedia, ML, SVG.

ICOM6020. Advances in wireless communications

This is a new course for ICOM students. As you may be aware, wireless communication is definitely a very hot topic in the coming few years and there are many different magic words today in the context of wireless communication. (e.g. GSM, GRPS, EDGE, W-CDMA, UMTS, bluetooth, WAP, circuit switched data, packet switched data, bearer services, ..etc). The course is targeted to give students a comprehensive overview of various technologies with appropriate depth. The concepts are explained in mostly qualitative manner without mathematical equations. The target audience will be the IT professionals with background in networking and protocols (strong background in communication engineering and mathematics are not required).

ICOM6021. Internet metadata

This module aims to cover specific Internet technologies dealing with the description of digital resources with Metadata. Metadata is an effective mechanism for the management of resources by enabling operations such as resource discovery, identification, declaration, usage control, workflow, and trading of content.

ICOM6022. Data warehousing, decision support and data mining

In this module, we examine the problems, principles, techniques, and mechanisms to support advanced information management and analysis using data warehousing techniques. In particular, we explore the current state-of-the-art in both data warehousing and decision support including data mining by studying the relevant literature and surveying selected products from industry.

ICOM6023. Java security

Java is designed so that programs can be dynamically loaded over the network and run locally. It is unlikely that Java user, such as Java-enabled browsers, will consider the security implications before running the Java programs. If the mobile code paradigm is going to work, security concerns should be addressed. As a result, Java was developed with key security issues in mind. The "Java Security Module" will provide an in-depth discussion on Java security technologies.

ICOM6024. QoS in IP networks

Today's Internet is best-effort. It guarantees neither transmission timeliness nor preservation of temporal ordering. With increased Internet traffic, multimedia applications have become more vulnerable to costly delivery delays and packet losses. Quality of Service (QoS) is a standards effort to provide consistent levels of service despite these delivery problems. This module will examine recent advances aimed at developing a next-generation network architecture that provides explicit support for the service requirements of networked multimedia applications. It helps the participants to develop a framework for evaluating each new QoS technology that promises to create a better Internet.

ICOM6025. Wireless networking

This course presents the state of art in wireless and mobile networking with a special emphasis on packet-oriented solutions. Wherever possible and appropriate, a contrast is made between these solutions and other solutions, such as cellular systems and ATM based systems (GSM, PCS, UMTS, HiperLAM/2, etc.)

ICOM6011. Project

ECOM6016. Electronic payment systems*

This module deals with technology and computer systems for managing and handling payments across electronic networks. It covers topics on payment gateways, clearance, credit card transactions, digital cash, micro-payments, authenticity, integrity, intermediaries and risk management.

ECOM6017. Human computer interaction*

This course is concerned with the design of the interaction between people and computers with particular emphasis on World Wide Web interaction. It is intended to give a comprehensive overview of the key issues of human-computer interaction (HCI) design, how the discipline evolved prior to the introduction of the Web,

how HCI research is applicable to Web design, and key issues expected in the future. Students will come away from the course with the ability to identify issues and tradeoffs in interaction design, and to invent and evaluate alternative solutions to design problems. These abilities will be directly applicable to the design of Web sites that require a high level of user interactivity such as e-commerce sites.

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*cross-listed in the both ECom and IComp curriculum

MSC(ENG) IN MECHANICAL ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the field of Mechanical Engineering.

A taught Master student will not be permitted to select a course the contents of which are similar or identical to any course he/she has previously taken for the purpose of fulfilling the requirements of another degree.

The list below is not final and some courses may not be offered every year.

MECH6007. Project (4 modules)

Students will undertake an assigned and supervised project which will be assessed. The project must relate to the subject matter of the curriculum and be agreed by the Department of Mechanical Engineering.

MECH6009. Solar energy application

Radiant heat transfer, sun-earth trigonometry, beam and diffuse radiation, collector types, solar heating and cooling, system design, tracking, direct conversion.

MECH6010. Service behaviour of materials

Service behaviour and selection; high temperature - overageing, oxidation, creep; low temperature brittle fracture; fatigue; wear; corrosion; radiation damage in nuclear reactors. Failure analysis case studies for steels and aluminium or copper alloys.

MECH6012. Structural analysis and engineering fracture mechanics

Analysis of determinate and indeterminate plane and space structures; energy methods of structural analysis; analysis of plane and shell structures; instability of frameworks, plate and shell structures; introduction to engineering fracture mechanics; design against fracture and fatigue failure.

MECH6013. Computational and experimental stress analysis

Fundamental concepts of numerical solutions, direct and energy formulation of finite element models, solution techniques, material and geometric nonlinearities. Strain gauge method, photoelasticity, Moire and interferometric methods.

MECH6014. Digital control and signal processing

Digital control systems; z-transform and state variable methods; compensation; digital control algorithms; general applications of signal processing; Fourier series and line spectra; discrete and fast Fourier transforms; digital filtering.

MECH6015. Tribology - theory and application

Nature of surfaces, friction, wear; hydrostatic, hydrodynamic and elasto-hydrodynamic lubrication; limitations of film lubrication theory; rolling bearings; bearing design and materials; lubricants; relationship between machine and bearing systems; tribological failures; operation and condition monitoring of bearing systems.

MECH6017. Noise and vibration

Fundamentals theory of noise and vibration; response of human ear and hearing loss; noise measurement; noise in rooms, acoustic absorption and transmission through walls; noise control; vibration measurement and condition monitoring; vibration and shock control, including isolation, absorbers and damping; dynamic balancing of rotors *in situ*.

MECH6018. Micrometeorology and atmospheric diffusion

Atmospheric dynamics; boundary layer; turbulence; gradient, statistical and Lagrangian similarity diffusion theory; plume rise; bluff body aerodynamics and wind-tunnel modelling.

MECH6019. Air pollution chemistry and control

Air pollutants in the atmosphere; combustion; gas-phase atmospheric chemistry; aqueous-phase atmospheric chemistry; aerosols and particulate matter; air pollution control and removal of air pollutants.

MECH6020. Computational heat transfer and fluid flow

Mathematical description of physical phenomena; nonlinearity; source-term linearization; discretization methods; schemes for convection; false diffusion; methods for solving algebraic equations; explicit and implicit schemes; overrelaxation and underrelaxation; staggered grid; velocity-pressure de-coupling schemes; applications.

MECH6021. Marine hydrodynamics

Development of hydrodynamic principles and their applications to marine vessels and structures. Dimensional analysis, similitude and model testing; viscous and ideal flows; lifting surfaces; wave, wave loading on small and large bodies; response of floating bodies to wave; hydrodynamics of slender bodies.

MECH6022. Offshore engineering design

Offshore structural configurations; environmental conditions, design criteria and code requirements; deterministic and stochastic design approaches; design of offshore structures; numerical methods for marine applications.

MECH6023. Power plant technology

Historical development, energy resources, steam and vapour cycles, boilers, fuels and combustion, steam turbines, principles of nuclear energy, radioactivity, reaction rate and power shape, nuclear reactor thermal-hydraulics, Pressurized Water Reactor power plant and its design limits.

MECH6024. Applied mathematics for engineers

Two topics selected from (1) computational techniques in engineering, (2) variational methods in mechanics, and (3) statistical methods in engineering.

MECH6025. Marine propulsion plant

Machinery systems; design criteria; prime mover efficiency; energy saving methods. Propulsion; fixed and controllable pitch propellers; design procedures; matching of hull, propeller, diesel engine and turbocharger. Marine shafting design; alignment; vibration; thrust and tail shaft bearings.

MECH6026. Computational thermal fluid dynamics

Fundamental concepts and equations of thermal fluid dynamics; solution of linear equation systems; numerical solutions of partial differential equations.

MECH6028. Processing and service behaviour of engineering plastics

Extrusion; injection moulding; blow moulding; solid phase forming; recycling; rapid prototyping. Viscoelastic behaviour of plastics; design methods for plastics based on deformation data; dynamic behaviour and hysteresis losses; fatigue; UV degradation; flame retardance; introduction to polymer-matrix composites.

MECH6002. New technical ventures based on technology and engineering

A survey course of broad interest which covers the actual process of getting a new high-technology venture started, growing, and developing a personal entrepreneurial plan including harvesting. Emphasis will be on discovering the concepts of entrepreneurship and the competencies, skills, team development, resources, and involvement required to make the process successful in a technology related business.

MECH6001. Advanced design methods and applications

Engineering design, design theory and methodology: e.g., axiomatic design, optimization design, design for manufacturability, and design for assembly.

MECH6003. Advanced fluid mechanics

Fundamental concepts and equations; hydrodynamic lubrication; boundary layers; turbulent flow; pipe flows; open channel flows.

MECH6029. Computer-aided design applications

Design analysis of problems; finite element applications in design, stress analysis, heat transfer, vibration problems in design and solutions by computer packages; optimization in design; case studies.

MECH6030. Computer control for manufacturing processes

Structure of process control computers; interface; z-transform, sampling theory; discrete-time models; stability analysis; discrete controller design; optimal control; state space representation and controller design; parameter estimation; self-tuning controllers; control applications.

MECH6031. Computer automated inspection

Mechanical gauging; coordinate measuring machine; tactile sensors; electromagnetic sensing; optical gauging and profiling; surface roughness inspection; image acquisition and storage; lighting and optical system; image processing and understanding; location and range extraction; 2-D and 3-D representation; pattern recognition and decision making; speckle metrology.

CIMA6001. Geometric modelling and computer graphics

2D, 3D geometric modelling principles: information representation and manipulation, mathematical bases, graphics rendering techniques; elements of computer graphics; graphics packages and standards; data exchange standards.

CIMA6004. Computer-aided manufacturing

Numerical control principles and applications; computer aided process planning; industrial robots; flexible manufacturing systems; computer aided production management; computer aided process control and quality control; applications of AI in manufacturing; CAD/CAM evaluation and implementation; computer integrated manufacturing (CIM).

MSC(ENG) IN STRUCTURAL ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the field of Structural Engineering. A candidate is permitted to proceed on a course of study under E16(a)(ii)(2) of the MSc(Eng) Regulations.

The list of courses below is not final, and may be changed from time to time. Courses are one-module courses unless otherwise specified.

At least FIVE modules from the following list of courses or courses approved by the Department of Civil Engineering:

CIVL6002. Advanced finite elements

Isoparametric elements; boundary integrals; dynamics and stability; non-linear analysis; finite strip method.

Prerequisite: CIVL6026 Finite element method

CIVL6003. Advanced reinforced concrete structure design

Flexural, shear and torsional behaviours of reinforced concrete members; yield line theory; strut and tie theory; effects of confinement reinforcement; design of reinforced concrete frames and shear walls; design of high-strength concrete members.

CIVL6008. Bridge engineering

Choice of structural systems; construction materials; construction methods; loading on bridges; analysis of bridge decks; bridge substructures; introduction to bridge bearings and joints.

CIVL6011. Computational methods

Linear equations; non-linear equations; eigenvalue problems; finite difference; optimization; large scale problems; perturbation methods.

CIVL6013. Concrete technology

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6020. Design of earthquake resistant structures

Introduction about earthquake, general philosophy, concept of ductility; structural system and configuration, lateral load resisting system and earthquake force distribution; structural design consideration, code consideration, aspects of detailing; overview of strengthening and retrofitting, overview of external devices as earthquake resisting system.

CIVL6026. Finite element method

Elasticity; calculus of variation; energy methods; shape functions; two and three-dimensional problems; bending elements; field problems.

CIVL6032. Long-span structures

Design strategies for long-span structures; arches; domes; cable-supported structures; suspension and cable-stayed bridges; space frames; membrane structures; hyperbolic paraboloids.

CIVL6045. Tall building structures

Coupled shear/core walls; coupling effects of beams and slabs; finite element analysis of building structures; wall-frame interaction; framed-tube structures; tube-in-tube structures; outrigger braced structures; shear lag effects in core walls.

CIVL6053. Wind engineering

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

CIVL6063. Special topic in structural engineering A

This course provides an opportunity for students to study in-depth an area of structural engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6064. Special topic in structural engineering B

This course provides an opportunity for students to study in-depth an area of structural engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6065. Earthquake engineering

Earthquake hazard, ground shaking and types of damage; seismic hazard assessment; site (soil) effects; structural response to earthquakes; elastic and inelastic response spectra; seismic design spectra; seismic capacity and risk assessment for new and existing structures.

CIVL6066. Structural dynamics

Theory of dynamics with applications to civil engineering structures; free and forced vibration; single and multi-degree of freedom dynamic systems; the nature and effects of earthquake and wind-induced vibrations; analysis of earthquake and wind dynamic response; deterministic and non-deterministic approaches.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

MSC(ENG) IN TRANSPORTATION ENGINEERING

The curriculum extends over not less than two and not more than three calendar years of study. It provides advanced education in the field of Transportation Engineering. A candidate is permitted to proceed on a course of study under E16(a)(ii)(2) of the MSc(Eng) Regulations. Courses are one-module courses unless otherwise specified. The list below is not final and some courses may not be offered every year.

(A) At least FIVE modules from the following list of courses or courses approved by the Department of Civil Engineering:

CIVL6007. Behavioural travel demand models

This course will cover the basic as well as modern and advanced techniques in travel demand modelling. Topics will include demand theory, mathematical models, survey methods in transport, land use transportation models, disaggregate choice models, and behavioural concepts in choice modelling.

CIVL6025. Environmental impact assessment of engineering projects

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

CIVL6035. Highway pavement engineering

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6037. Project management - human and organizational factors

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6046. Theory of traffic flow

Measurements and statistical distributions of traffic characteristics; traffic stream models; car-following theories; hydrodynamic theory of traffic flow; traffic queues and delays.

CIVL6047. Traffic management and control

Transportation networks; network equilibrium concepts; estimation of origin-destination matrix; traffic management measures; traffic control techniques.

CIVL6048. Planning of transport infrastructure systems

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6049. Urban development management by engineering approach

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6054. Engineering for transport systems

The course will introduce students to the basic performance characteristics of various transportation modes for passengers and freight. The focus will be on the interaction between performance and factors related to transportation technology, facility, system design and patterns of demand.

CIVL6056. Special topic in transportation engineering A

This course provides an opportunity for students to study in-depth an area of transportation engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6057. Special topic in transportation engineering B

This course provides an opportunity for students to study in-depth an area of transportation engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.